Chapter 1
An Introduction to A&P

Introduction

• Study strategies crucial for success
  – Attend all lectures, labs, and study sessions
  – Read your lecture and laboratory assignments before going to class or lab
  – Devote a block of time each day to your A&P course
  – Set up a study schedule and stick to it
  – Do not procrastinate!
  – Approach the information in different ways
  – Develop the skill of memorization, and practice it regularly
  – As soon as you experience difficulty with the course, seek assistance

Introduction
• Anatomy and physiology affect your life everyday
  – Anatomy is the oldest medical science
    • 1600 B.C.
  – Physiology is the study of function
    • Biochemistry
    • Biology
    • Chemistry
    • Genetics

Structure and Function

• Anatomy
  – Describes the structures of the body
    • What they are made of
    • Where they are located
    • Associated structures
  – Physiology
    • Is the study of
      • Functions of anatomical structures
      • Individual and cooperative functions

Anatomy and Physiology Integrated

• Anatomy
  – Gross anatomy, or macroscopic anatomy, examines large, visible structures
    • Surface anatomy: exterior features
    • Regional anatomy: body areas
    • Systemic anatomy: groups of organs working together
    • Developmental anatomy: from conception to death
    • Clinical anatomy: medical specialties

Anatomy and Physiology Integrated

• Anatomy
  – Microscopic anatomy examines cells and molecules
    • Cytology: study of cells and their structures
    • cyt- = cell
    • Histology: study of tissues and their structures
Anatomy and Physiology Integrated

• Physiology
  – **Cell physiology**: processes within and between cells
  – **Special physiology**: functions of specific organs
  – **Systemic physiology**: functions of an organ system
  – **Pathological physiology**: effects of diseases

Levels of Organization

• **The Chemical (or Molecular) Level**
  – Atoms are the smallest chemical units
  – Molecules are a group of atoms working together

• **The Cellular Level**
  – Cells are a group of atoms, molecules, and organelles working together

• **The Tissue Level**
  – Tissues are a group of similar cells working together

• **The Organ Level**
  – An organ is a group of different tissues working together

Levels of Organization

• **The Organ System Level**
  – Organ systems are a group of organs working together
  – Humans have 11 organ systems

• **The Organism Level**
  – A human is an organism
Homeostasis

- **Homeostasis**: all body systems working together to maintain a stable internal environment
  - Systems respond to external and internal changes to function within a *normal range* (body temperature, fluid balance)
  - Failure to maintain homeostasis leads to illness or even death
  - Homeostatic regulation is the adjustment of physiological systems to preserve homeostasis
Homeostasis

- Homeostatic regulation occurs via two general mechanisms: autoregulation and extrinsic regulation

- Autoregulation (intrinsic)
  - Automatic response in a cell, tissue, or organ to some environmental change
  - When oxygen levels in a tissue decline, the cells release chemicals that cause the dilation of local blood vessels thus increasing blood flow and as a consequence increasing oxygen availability

Homeostatic Regulation

- Regardless of the system(s) involved, the regulatory machinery consists of three parts
  - A receptor or sensor that detects a specific stimulus
  - A control center or integration center that receives and processes information from the receptor
  - An effector, a cell or organ that responds to the control center and either opposes or amplifies the stimulus

Feedback-Control Systems

- In order to maintain homeostasis the control center must have continuous information from the sensor so that it can initiate regulatory action
- Feedback occurs when sensory information about a particular variable (temperature, pH, etc) is used to control the processes that influence that variable
- There are two types of feedback-control systems; Negative Feedback and Positive Feedback

Negative Feedback

- We are all familiar with negative feedback.
- It is the mechanism by which your home thermostat regulates the temperature of your house
- Negative feedback occurs when variation outside a desired range triggers a response that corrects the situation
- Most homeostatic regulation involves negative feedback
Positive Feedback

• In positive feedback, an initial stimulus amplifies the change in the original condition.
• In physiological systems, positive feedback is often the control mechanism that regulates stressful or dangerous processes that must be completed quickly.
• Regurgitation is a good example, once you start to puke you usually don’t stop until your stomach has emptied.

A Frame of Reference for Anatomical Studies

• Early anatomists needed to be able to communicate anatomically information effectively.
• Out of this need arose a special language of anatomy to refer to anatomical landmarks, regions and directions of the human body.
• A familiarity with this language will aid us in our study of anatomy and physiology.

Superficial Anatomy

• Superficial anatomy breaks the body into anatomical landmarks and regions.
• Standard anatomical illustrations show the body in anatomical position, with hands at the side and palms facing forward.
• A person lying down in the anatomical position is said to be supine when facing up and prone when facing down.

Anatomical Terminology

• Superficial Anatomy
  – Anatomical Landmarks
    • References to palpable structures
  – Anatomical Regions
    • Body regions
    • Abdominopelvic quadrants
    • Abdominopelvic regions
  – Anatomical Directions
    • Reference terms based on subject
Anatomical Regions

- To provide more specific location in the abdominal and pelvic region, clinicians refer to four abdominopelvic quadrants. Anatomists are a bit more precise using 9 abdominopelvic regions.
- Also note that left and right always refer to the left and right sides of the subject not the observer.
Anatomical Terminology

**FIGURE 1–7 Abdominopelvic Relationships.**

- **Regions and Quadrants of the Peritoneal Cavity**
- There are (a) nine abdominal regions and (b) four abdominal quadrants in the peritoneal cavity.

<table>
<thead>
<tr>
<th>Table 1-2 Directional Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Anterior</td>
</tr>
<tr>
<td>Posterior or dorsal</td>
</tr>
<tr>
<td>Caudal or caudal</td>
</tr>
<tr>
<td>Superior</td>
</tr>
<tr>
<td>Inferior</td>
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<tr>
<td>Medial</td>
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<tr>
<td>Lateral</td>
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<tr>
<td>Cranial</td>
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<tr>
<td>Caudal</td>
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<tr>
<td>Superior</td>
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<tr>
<td>Anterior</td>
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<tr>
<td>Posterior</td>
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<tr>
<td>Superior</td>
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<tr>
<td>Inferior</td>
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<tr>
<td>Proximal</td>
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<tr>
<td>Distal</td>
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</tbody>
</table>

- **Directional Terms Applied to the Human Body**
- Paired directional terms are shown as applied to the human body.
Anatomical Terminology

- Sectional Anatomy
  - Planes and sections
    - **Plane**: a three-dimensional axis
    - **Section**: a slice parallel to a plane
    - Used to visualize internal organization and structure
    - Important in radiological techniques
      - MRI
      - PET
      - CT

- Planes of the Body
  - The three planes most commonly used in anatomical and medical imaging are the sagittal, frontal (or coronal), and transverse plane.

**Figure 1–9 Sectional Planes.**

- The transverse plane divides the body into superior and inferior
- The frontal (coronal) plane divides the body into anterior and posterior
- The sagittal plane divides the body into left and right
- The midsagittal plane divides the body exactly down the middle

**Table 1–3 Terms That Indicate Sectional Planes**

<table>
<thead>
<tr>
<th>Plane</th>
<th>Direction of Plane</th>
<th>Functional Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse</td>
<td>Perpendicular to long axis</td>
<td>Transversely or horizontally</td>
<td>A transverse, or horizontal, section separates superior and inferior portions of the body. A cut through the body parallel to long axis is called a cross section.</td>
</tr>
<tr>
<td>Sagittal</td>
<td>In plane of body</td>
<td>Sagittally</td>
<td>A sagittal section separates left and right portions of the body, as if a cut through the midsagittal plane.</td>
</tr>
<tr>
<td>Midsagittal</td>
<td>In midsagittal plane or median section the plane passes through the middle of the body, dividing the body into right and left halves.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parasagittal</td>
<td>Parasagittal section which is just posterior to the midsagittal plane separates the body into right and left portions of unequal size.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frontal</td>
<td>Frontally or craniad</td>
<td>Frontally or craniad</td>
<td>A frontal, or coronal, section separates anterior and posterior portions of the body, coronal usually refers to section passing through the skull.</td>
</tr>
</tbody>
</table>

Body Cavities

- Many vital organs are suspended within body cavities.
- These cavities have two functions
  - To protect delicate organs from accidental shocks and to cushion them from bumps and thumps as we move around
  - They allow internal organs, such as the stomach, lungs, heart, and bladder to expand and contract without affecting surrounding tissues and nearby organs
The Dorsal Body Cavity
- The dorsal body cavity refers to the fluid filled space surrounding the brain and spinal cord.
- It includes the cranial cavity, containing the brain, and the spinal cavity, containing the spinal cord.

The Ventral Body Cavity
- The ventral body cavity, or coelom, contains the organs of the respiratory, cardiovascular, digestive, urinary, and reproductive systems.
- The ventral body cavity is subdivided by the diaphragm into the superior thoracic cavity and the inferior abdominopelvic cavity.

The Thoracic Cavity
- The thoracic cavity contains the heart and lungs.
- It is subdivided into the left and right pleural cavities and the mediastinum.
  - Each pleural cavity contains one lung lined by a slippery serous membrane called the pleura.
  - The mediastinum contains the pericardial cavity.
  - The heart is surrounded by another serous membrane, the pericardium.

Body Cavities
- Serous membranes
  - Line body cavities and cover organs.
  - Consist of parietal layer and visceral layer.
    - Parietal layer — lines cavity.
    - Visceral layer — covers organ.
Serous Membrane
Serous membrane lines the pericardial cavity and reflects back to cover the heart—much the same way that an underinflated balloon would form two layers surrounding a fist.

Body Cavities

• The Abdominopelvic Cavity
  – Peritoneal cavity — chamber within abdominopelvic cavity
    • Parietal peritoneum lines the internal body wall
    • Visceral peritoneum covers the organs

The Abdominopelvic Cavity

• The abdominopelvic cavity extends from the diaphragm to the pelvis
• It is subdivided into the abdominal cavity which extends from the diaphragm to the superior margins of the pelvis and contains the liver, stomach, spleen and most of the large intestine
• Its second division, the pelvic cavity is bordered by the pelvis, with a floor of muscle and containing the reproductive organs, urinary bladder and the final portion of the large intestine